STATEMENT OF WORK
for
250 TON CHILLER REPLACEMENT PROJECT
AT
OFFICE BUILDING CHANCERY
RIYADH, SAUDI ARABIA

PROJECT NO. XJ-OM-0174

June 22, 2013

U.S. DEPARTMENT OF STATE

1.0 INTRODUCTION

1.1 The U.S. Department of State (DOS) requires professional construction services to perform construction for the following:

- Replacement of two nominal 250 ton centrifugal air-cooled chillers (CH-3 & CH-4) with two government furnished, 250 ton air-cooled screw chillers at the Riyadh Chancery Office Building (OBC),
- Replacement of the chilled water pumps with government furnished pumps for both the 250 ton chillers and for the two 125 ton chillers, and
- Conversion of the chilled water system controls to variable flow pumping system.

2.0 PROJECT BACKGROUND

2.1 The Chancery Office Building (OBC), Marine House (MSGQ), USERA and Uncle Sam's Recreation Club are served by the central chilled water plant located on the roof of the USERA/Central Plant section of the embassy complex. The primary cooling equipment consists of four air-cooled chillers, two having 250 tons (nominal) cooling capacity and two having 125 tons (nominal) cooling capacity. Any combination of chiller size can be operated with their associated sized pumps. As two-way modulating AHU chilled water control valves close, a pressure sensor near the bypass control valve opens to allow supply chilled water to bypass the chilled water coils in the AHU water loop. The larger chillers are Trane air-cooled centrifugal chillers that originally used CFC-12 (R-12) refrigerant and were rated at 250 tons at 1.35 kW/ton; in 1996 the chillers were converted to HFC-134A (R-134A) resulting in a de-rating to 236 tons at 1.53 kW/ton. The two original Trane 125 ton CFC-11 (R-11) air-cooled centrifugal chillers were replaced in 2001 with two Trane 125 ton HFC-134A air-cooled screw chillers.

2.2 The existing chilled water pumps are Aurora horizontal split case pumps that have water packing seals and standard efficiency motors. The pumps are dedicated to each chiller. Post has procured replacement pumps with mechanical seals, high efficiency motors with variable frequency drives.

2.3 The central plant is required to operate continuously. When the embassy compound was first opened, the main consideration for selection of chiller operation was that each operating chiller be 50 percent to 75 percent loaded. Inactive chillers were separated from the chilled water loop by manually closing all isolation valves. Chiller operation was split between day (06:30– 17:30) and night (17:30–6:30) with alternating chillers used according to cooling requirements. During daytime operations the chilled water supply temperature set point was 45^{o}F and during nighttime operations the chilled water supply temperature was setback to 50^{o}F. The following was a summary of seasonal operations used thru 2001:

Dates:	Chillers Operating:
January 3 thru March and most of April	1 large chiller (C1 or C2) during the day; 1 small chiller (C3 or C4) at night
From April 24 to May 17	2 large chillers (C1 & C2) during the day w/1 large chiller operating for only 4-5 hours as needed; 1 small chiller (C3 or C4) at night
From May 17 to June 11	2 large chillers (C1 & C2) during the day; 1 small chiller (C3 or C4) at night
From June 11 to November 9	2 large chillers (C1 & C2) during the day; 2 small chiller (C3 & C4) at night
From November 9 to December 10	1 large chiller (C1 or C2) during the day w additional large chiller required to operate only 4-5 hours for a few days; 1 small chiller (C3 or C4) at night
From December 10 to January 3	2 small chillers (C3 & C4) during day and 1 small chiller at night

This work is intended to be performed with the installation of the first chiller as soon as the Contractor is able to obtain necessary materials for the installation as one chiller is already out of service. The installation start date of the second chiller is no earlier than November 23 for preparation of the piping system and December 10 for installation of the new chillers and pumps. Construction Period is to be no longer than 45 days from Notice to Proceed (NTP) for the rough-in work, to commissioning of the equipment, thru site clean-up.

2.4 As part of the 2001 125-ton chiller replacement project, a chiller control system was installed as follows:

A. The four chillers were connected to Trane Tracer BAS system with a Chiller Plant Automation Panel.
B. Trane Company built-in microprocessor based UCP-2 FastPak controls were installed on Chillers 1 & 2. The temperature reset controls in these panels were to be programmed to reset chilled water temperatures to vary over a five degree range (from 45°F to 50° F) while the outside air temperature varies over a 60°F range (from 110°F to 60° F).

The Trane Tracer system was intended to be connected to the Honeywell Excel system with a router but instead was connected for only start-stop of the pumps and interfaced into the operation indicator lamps in the Honeywell Central Plant Equipment Operation Panel. The chiller operation is still manually controlled.

3.0 PROJECT DESCRIPTION

3.1 For the Project the Contractor shall prepare a Bid-Build proposal for the project, and upon award, shall perform the installation/construction work.

3.2 The Project includes the following work:

- Remove chillers C-1 & C-2. Disconnect power and control circuits. Disconnect and remove chilled water piping back to points shown on attached drawing DM-1.
- Install new chillers C-1 & C-2 in locations shown meeting the NEC code required distances between power panel and roof perimeter walls.
  Purchased Chiller Schedule:
  Manufacturer/model numbers: Daikin McQuay, AWS310BDP. Capacity, 271.6 tons; refrigerant – R134a; efficiency – high, EER-11.3 @ ARI conditions, IPLV is 19.4 EER; condenser ambient range is high ambient of 115^{0}F at elevation of 2000 ft.; chiller provided with compressor sound package to be field installed by Contractor; Evaporator: 2 pass, entering/leaving water temperatures - 58^{0}F/44^{0}F, GPM – 465.7 GPM (Pump provided is scheduled at 442 GPM) @ 9.00 ft. of water pressure drop; Minimum Flow Rate – 405.2 GPM; evaporator fouling factor 0.0001 hr-sq. ft.-deg F/Btu; Sound Pressure (@ 30 Ft.) – Overall 72 dBA; Sound Power – Overall 98 dBA.
  Electrical: 460V, 3 ph., 60 Hz; total unit power 409.3 kW, total compressor power - 395.7 kW, 20 condenser fan motor horsepower, each 1.4 HP, total fan power 20.86 kW.
  Unit Electrical Data from manufacturer literature:

Description:	Single Pt (Power Block)	Multi-Point (Disconnect)	
		Circuit 1	Circuit 2
Dual point power MCA	569	288	332
Field Wire Gauge	300 MCM	350 MCM	400 MCM
Field Wire Quantity	6	3	3
Conduit Quantity	2	1	1
Conduit Nominal Size	2.5”	2.5”	2.5”
Recommended Fuse Size, A	700	400	500
Maximum Fuse Size, A	800	450	500
Terminal Amps, A	620	N/A	N/A

Disconnect Amps, A	N/A	400	400
Connector Wire Range	(2/Phase) 6-350 MCM	(1/Phase 1-600 MCM	(1/Phase) 1-600 MCM

Please see Daikin McQuay Chiller Package and supplied PDF & CAD files for complete chiller data.

- Install new 150-mm chilled water piping (schedule 40 black steel) from demolition point to the chillers. Connect to chiller with stainless steel expansion hoses using Victaulic coupling connections. Install new butterfly valves with dual tapped flanges to allow removal of piping between valve and the chiller evaporator system for servicing. Install new balancing valve in the chilled water supply line. Install new thermometers and pressure gauges in the chilled water supply and return pipes.
- Chilled water piping shall be insulated with 50-mm thick Foam-glass insulation and aluminum metal jacketing.
- Replace 2 existing 500A circuit breakers with 2 new 700A circuit breakers (CB) on 2000A switchboard. The new 700A CB shall be the same type as existing CB. Provide 2 disconnect switches (DS) and associated wiring. The DS shall be 700A, 3 poles, 4-wire, 600V rating, NEMA 3R, Square D. See attached typical new chillers 1 and 2, and DS 1 and 2 for power diagram configuration. All electrical construction and installation shall be performed in accordance with OBO-SED-Div 26, National Electrical Code (NEC) and the National Fire Protection Agency (NFPA) 70. See attached OBO-SED Div 26 (partial) for specifications.
- Controls New Work at chillers: Disconnect control circuits from existing chillers and connect control wiring to chiller C-1 & C-2 control panel boards. If necessary connect/extend new chiller BAS circuit back to the Trane Trace Summit front end located in the Engineer's office on the second floor of the Central Plant. Note that in future all four Post chillers will be connected into a new BacNet compliant BAS system in this office.
- Pump Room: Replace the existing chilled water pumps P-1 & P-2 which serve chillers C-1 & C-2, respectively and chilled water pumps P-3 & P-4 which serve chillers C-3 & C-4 respectively. These are horizontal split case pumps with water seal packing manufactured by Aurora. The new pumps are horizontal split case pumps with mechanical seals and premium efficiency, inverter duty motors. The pump starter/disconnect switches shall be replaced with government provided variable speed drives (VFDs) with internal disconnect switches. The schedule for the pumps are as follows:

  Pumps P-1 & P-2: Aurora series 411BF, size 3x4x14; 442 GPM @ 115 ft. of water head; 460V/3 ph./60 Hz electrical characteristics, 25 HP, premium efficiency, inverter duty motor.
  Pumps P-3 & P-4: Aurora series 411BF, size 2.5x3x12; 213 GPM @ 110 ft. of water head; 460V/3 ph./60 Hz electrical characteristics, 15 HP, premium efficiency, inverter duty motor.

- Ensure that all equipment, stands/mounting plates, meters/sensors, cables and any other item required to install the VFDs including labor are accounted for and available. Only the pumps and the VFDs are supplied by Embassy for installation by the contractor along with the chillers for this replacement project.
- Verify operation of the differential pressure bypass line in the central plant pump room. Adjust pump variable speed controllers to maintain design flow for each chiller.
- The contractor shall provide a least a CAT7/CAT5e Ethernet Patch cable, Snag-less that can support networking at Gigabit Ethernet speed up to minimum 1000Mbps. The contractor shall provide this cable or any cable necessary to meet the data transfer without corruption so that a future new BAS system can be installed to control the chillers in such a manner that the length of cable required does not exceed the maximum operational length of the cable specifications.

4.0 CRITERIA:

4.1 Codes and Standards: The Contractor shall perform the demolition and installation in accordance with the following codes and standards:

A. NFPA 70, National Electric Code, 2011.

B. International Building Codes – 2009 including OBO Code Supplement – 2012 requirements. These are available from the Post FM.

4.2 OBO Specifications: The Contractor shall perform work in compliance with OBO Master spec specifications. These are available from the Post FM.

4.3 **Logistics:**

a) Staging/storage areas available on Embassy grounds. Area available may be limited and shall be adjusted if special storage methods are required for materials.
b) Contractor to provide all access, handling and storage equipment needed to complete the replacement project.
c) The New Chillers shall be located at the Annex and their carnage and transportation from that storage location to the Chancery Roof should be allowed for by the contractor. The old removed/replaced chiller shall be transported back and off loaded at the Annex location too.
d) It is intended that One New Chiller shall be installed immediately after Notice to Proceed is issued by the Embassy/CO and the other during December 2013 if not earlier. Please note that the cost of two stage installation should be accounted for in the handling and transportation of the new and old chillers. This pricing proposal should be clearly separated and identified so it can be for a staged install or can be for consecutive install which shall be time dependant as to when the contract proposals are reviewed and issued.

5.0 **GENERAL REQUIREMENTS**

The contractor is required to visit the site and familiarize himself with the project, site conditions, working conditions and considerations that will affect both the contractor and the Embassy. The contractor is encouraged to highlight any elements that are noted during the site visit and clearly note them in his proposal. It is important that the contractor ensures that any elements that are considered crucial/critical and are apparent during the site visit are immediately communicated to the COR/Post FM and Designated Embassy staff.

5.1 Project Cost: This design is a part of a major program undertaken by the Department of State using public funds. Consequently, construction to a target construction contract cost estimate, adherence to delivery schedules, security classification, and handling guidance are mandatory performance parameters and cardinal indicators of the quality of work. Achievement of these performance parameters will be reflected in OBO's formal evaluation of the Contractor's accomplishments under this construction contract.

5.2 Design Changes: Any design changes initiated by either Post or OBO/PDCS/DE/ME will be presented to the Contractor by the Post FM. Prior to incorporating any change, the Contractor shall assess the impact on the established contract amount and provide that assessment to the FM. No changes may be incorporated by the Contractor without prior written approval from the Post FM. The Contractor will submit an updated estimate after any authorized adjustment to the design to budget amount.

5.3 The Contractor shall determine the price of materials, labor and equipment anticipated for all aspects of the construction project. The costs shall be itemized with separate columns for direct labor and direct materials. Indicate costs for general conditions, burdens and sub-contractors. Contract costs shall be expressed in terms of U.S. dollars (indicate the local currency conversion rate).

5.4 As-Built Drawing Format and CADD: Provide standard size CADD drawings for the work. All project documents shall be in "hard metric." All drawings, specifications, cost estimates, and other portions of submittals shall be prepared in English only.

5.5 Life Safety: The construction work shall take into account all applicable requirements of the Occupational Safety and Health Act of 1970, as amended, and the regulations promulgated pursuant thereto. If at any time during the construction it becomes apparent that a violation could exist, the Contractor shall notify the Post FM in writing requesting consultation to resolve the possible violation.

5.5 Building Codes: The relationship of U.S. and local codes and standards as they apply to construction in the host country shall be followed and whichever is the stringiest shall be applied by the Contractor. NFPA-70, the U.S. Electrical Code, provides a level of personnel and property safety which DOS must maintain in our overseas facilities.

5.6 Meetings: The Contractor shall prepare a detailed written record of all conferences and meetings with Post staff and representatives of OBO related to the Project. Confirmation of telephone conversations in which decisions affecting the project are made shall also be prepared in writing. Two (2) copies of these records shall be submitted to the Contracting Officer's Representative (COR) (Post FM) within five calendar (5) days of the event. The written format established by the Contractor for these records shall be subject to approval of the COR. Each record shall conclude with the following statement: "The matters reported in this document are considered by the (insert name of Contractor here) to be within the scope of this contract as presently priced, except for (Contractor to identify items or state "none") as further described below."

5.7 Proposal Manual: The Contractor shall provide the COR with a project proposal manual. This project manual shall provide regarding contract terms, project descriptions, equipment selections, and a detailed cost breakdown of the proposal.

5.8 Operating & Maintenance Manual: At completion of project, the Contractor shall provide Post Facility Maintenance Manager with two copies of the Operating & Maintenance Manual for the installed equipment. This may be better provided by discussion and help from Diakin McQuay. Please note that this should be outlined and provided as work proceeds in order for the review to be completed by the Embassy and handed over complete with as built drawing upon completion of the project. The project shall only be considered complete once the documents and operational training has been completed.

6.0 SPECIAL REQUIREMENTS

6.1 Energy Conservation and Sustainable Design: This project is to be a model of energy efficiency.

6.2 Chiller Factory & Commissioning Tests: Post FM and OBO/PDCS/DE/ME – Mike Ballentine shall be notified three weeks prior to installation commissioning of the chillers in order for OBO to witness the testing of the chillers for compliance with the specifications.

6.3 Operations and Maintenance (O&M) Manual: The Contractor shall be responsible to see that the project work is constructed using materials, finishes, fixtures, equipment, and systems that provide operational dependability and are easy to maintain or replace with those most readily available supplies and services.

A. O&M Design Guidelines: Emphasis must be placed on the uniformity of parts and components to maximize interchangeability.

B. The O&M manual shall contain for each piece of equipment the following items: general equipment catalog, replacement parts list, and service manual.

6.3 Comprehensive Maintenance Program (CMP): The Contractor shall provide specific operations and maintenance data and information for inclusion in the Post Comprehensive Maintenance Program (CMP) by the USG for the installed equipment. This may include at Post's option, a service contract for the installed equipment.

7.0 CONTRACT ADMINISTRATION

7.1 Contracting Officer (CO): The Contracting Office for this project shall be Riyadh Finance Office (FO) – Huma Desjardins.

7.2 Contracting Officer's Representative (COR): The contract proposal, drawings, project manuals, O&M manuals, etc., shall be submitted to the Post Contracting Officer. OBO/PDCS/DE/ME – Mike Ballentine will be COR for OBO; the Riyadh Facility Maintenance Manager (FM), Mr. Nat Marchiano or as designated by Post will be the COR at the American Embassy.

7.3 Technical Representative (TC): Mr. Mike Ballentine (OBO/PDCS/DE/ME) is designated as the Technical Representative for this project. The Technical Representative is responsible for reviews of submittals, commissioning witness of the chillers, and providing technical advice and substantive guidance to Post, inspection and such other purposes as deemed necessary under the contract.

7.4 Letters and Packages (or privately delivered mail) shall be addressed as follows:

U.S.A Embassy
ATTN: FO – Huma Desjardins
P.O. Box 94309
Riyadh 11693
Kingdom of Saudi Arabia

7.5 All deliverables shall include project identification: "250 Ton Chiller Replacement Project."

8.0 CONTRACT:

8.1 This is a firm fixed priced delivery order.

End of Statement of Work

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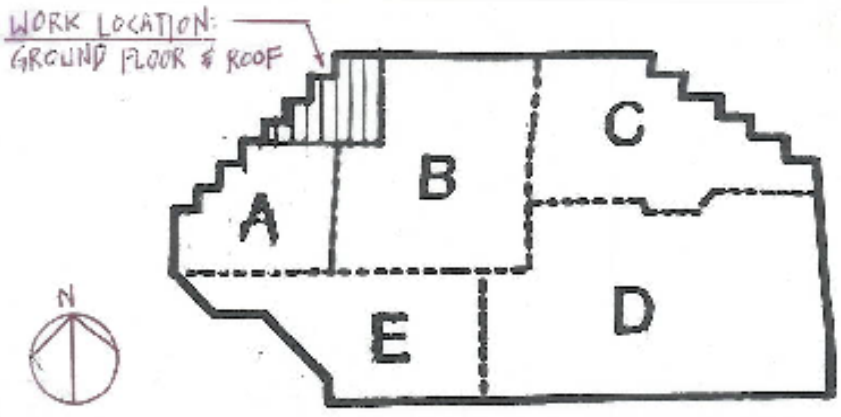
SBU

OBC 250 Ton Chiller Replacement Project

Riyadh, Saudi Arabia



SITE MAP - AMERICAN EMBASSY BUILDINGS

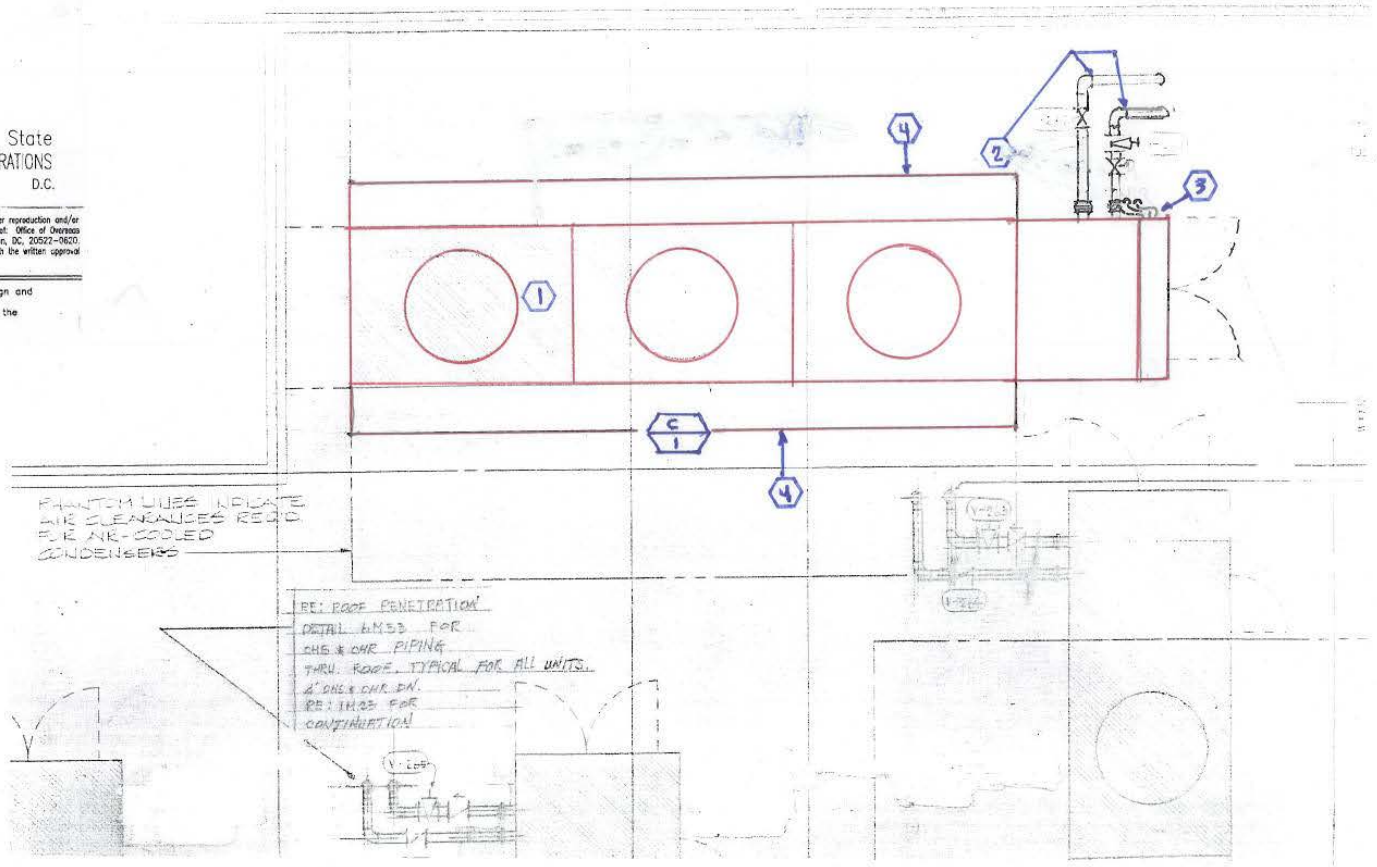
United States Department of State
OFFICE OF OVERSEAS BUILDING OPERATIONS
Washington, D.C.

SBU

OBC 250 TON CHILLER REPLACEMENT PROJECT
RIYADH, SAUDI ARABIA

SBU

United States Department of State
OFFICE OF OVERSEAS BUILDINGS OPERATIONS
Washington, D.C.



DEMOLITION NOTES:

1. REMOVE CHILLER CHILLER SHELL
2. REMOVE CHILLED WATER SUPPLY AND RETURN PIPING FROM, AND INCLUDING, THE FLEXIBLE CONNECTOR TO CHILLER.
3. DISCONNECT ELECTRICAL POWER AND CONTROL CONDUITS TO THE CHILLER
4. REMOVE & RETAIL CONDENSER COIL SHADE AWNINGS FOR MODIFICATION ONTO NEW CHILLERS

N

DEMO ROOF PLAN
DM-1
1:100

SBU

OBC 250 TON CHILLER REPLACEMENT PROJECT

RIYADH, SAUDI ARABIA

SBU

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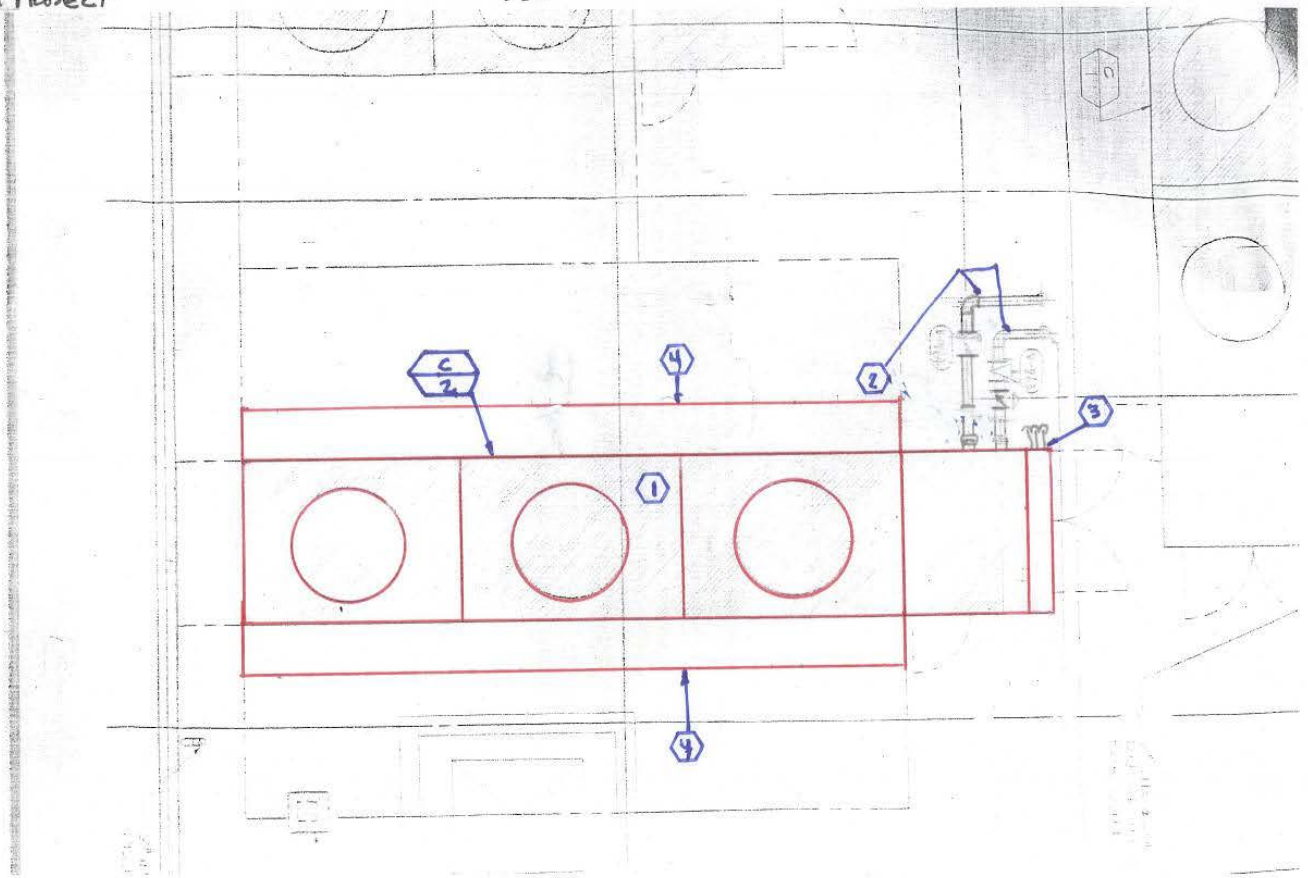
Washington, D.C.



DEMOLITION NOTES
SAME AS NOTES ON DWG DM.1, EXCEPT FOR CHILLER C-2.

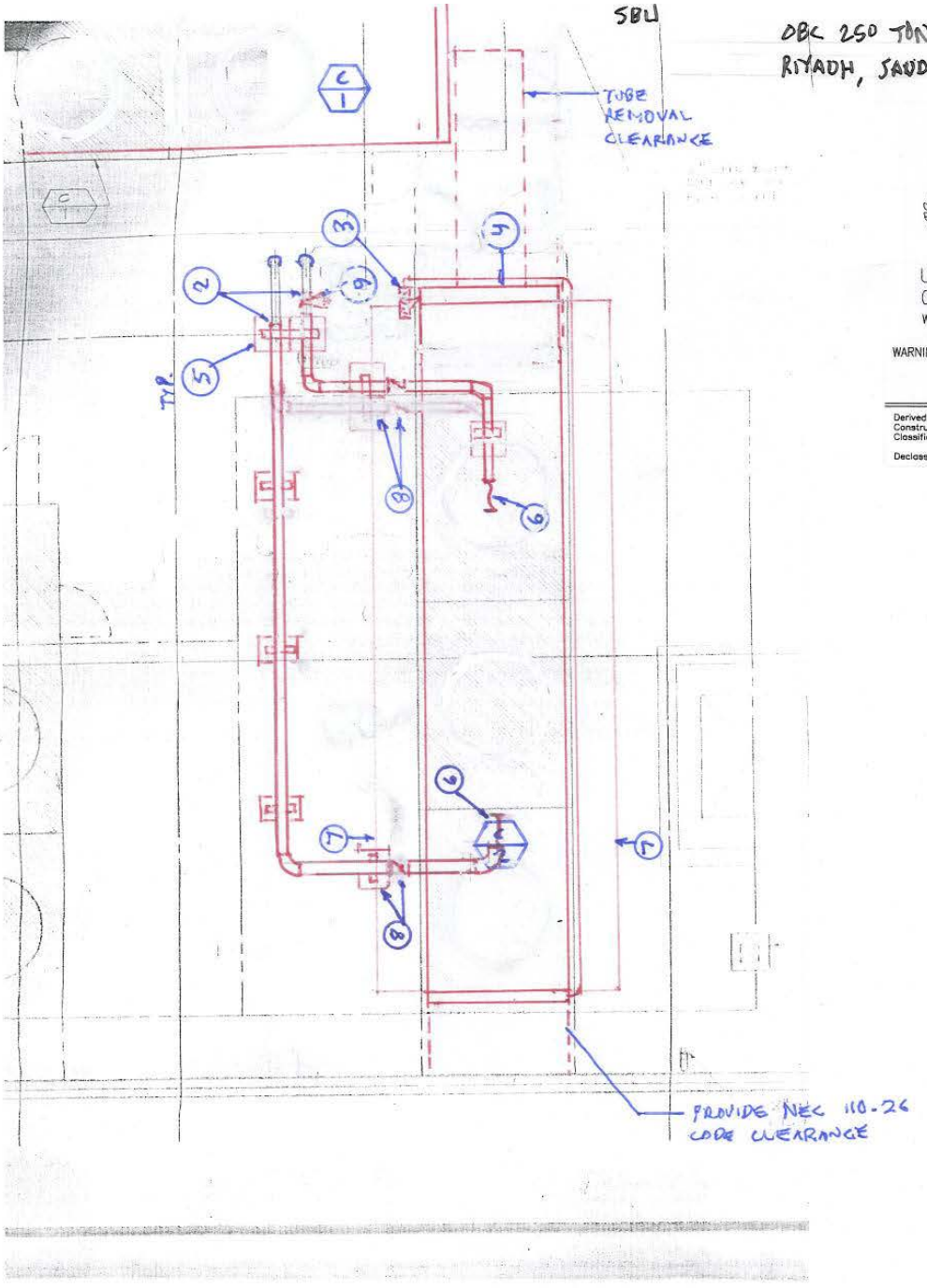
N

DEMO ROOF PLAN
DM-2
1:200

SBU

SBW

OBC 250 TON CHILLER REPLACEMENT PROJECT
RIYADH, SAUDI ARABIA



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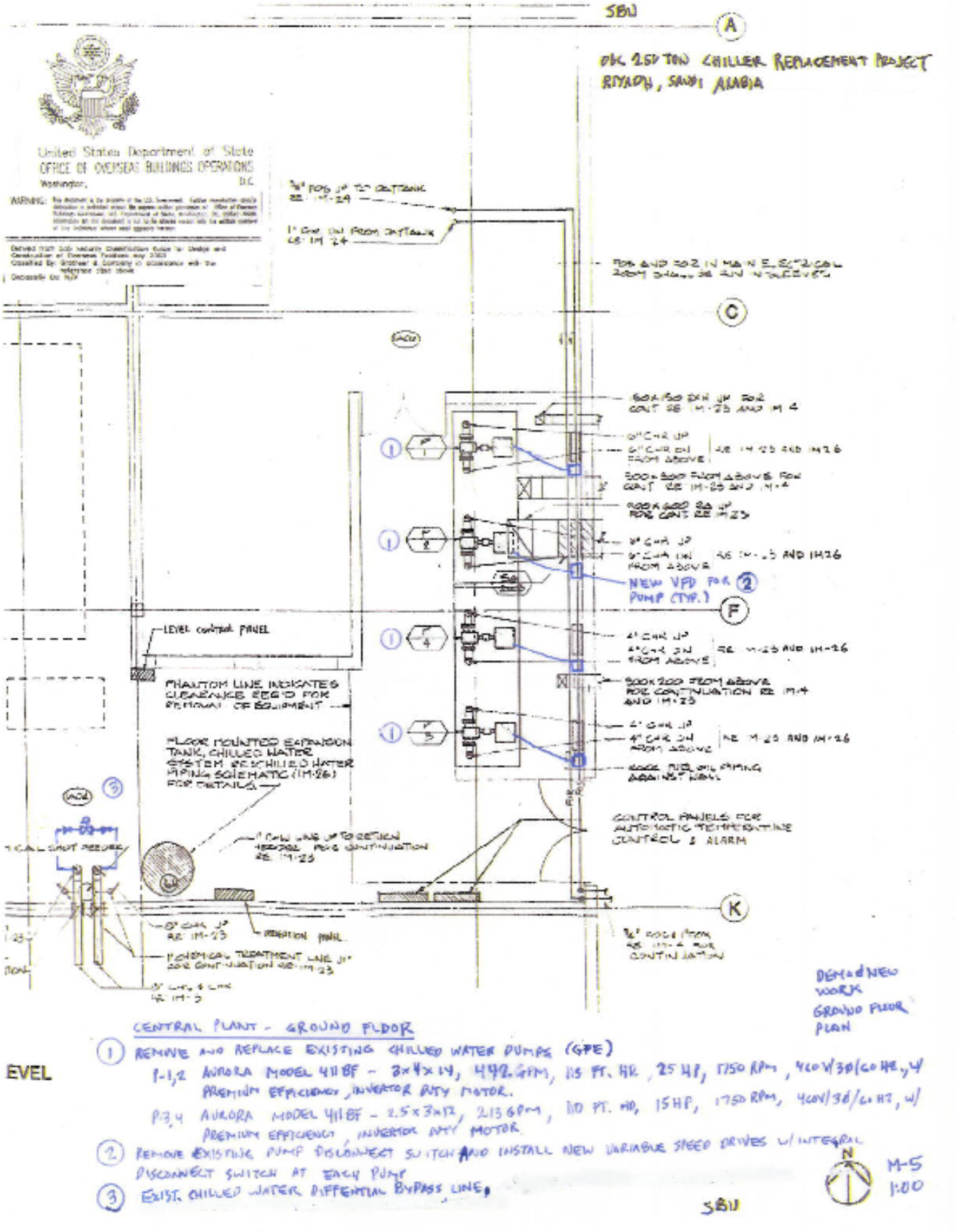
NEW WORK NOTES:
REFER TO M-3 FOR NOTES.

N

NEW WORK ROOF PLAN
M-4
1:100

SBW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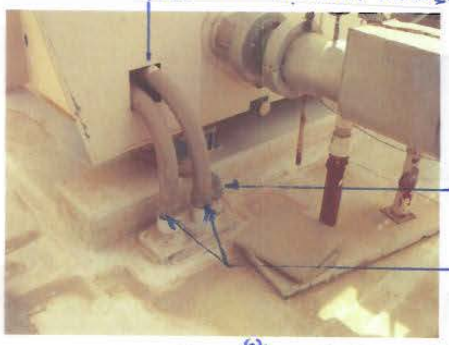
DIC 250 TON CHILLER REPLACEMENT PROJECT
RIYADH, SAUDI ARABIA
United States Department of State
OFFICE OF OVERSEAS BUILDINGS OPERATIONS
Washington, D.C.
WARNING:
C
F
K
LEVEL control PANEL
PHANTOM LINE INDICATES CLEARANCE REQ'D FOR REMOVAL OF EQUIPMENT
FLOOR MOUNTED EXPANSION TANK, CHILLED WATER SYSTEM RE CHILLED WATER PIPING SCHEMATIC (M-26) FOR DETAILS
NEW VFD FOR PUMP (TYP.)
CONTROL PANELS FOR AUTOMATIC TEMPERATURE CONTROL & ALARM
DEMO & NEW WORK
GROUND FLOOR PLAN
CENTRAL PLANT - GROUND FLOOR
1 REMOVE AND REPLACE EXISTING CHILLED WATER PUMPS (CPE)
P-1,2 AURORA MODEL 411BF - 3x4x14, 442 GPM, 115 FT. HD, 25 HP, 1750 RPM, 460V/3Ø/60 HZ, W/ PREMIUM EFFICIENCY, INVERTOR RTY MOTOR.
P-3,4 AURORA MODEL 411BF - 2.5x3x12, 213 GPM, 110 FT. HD, 15HP, 1750 RPM, 460V/3Ø/60 HZ, W/ PREMIUM EFFICIENCY, INVERTOR RTY MOTOR
2 REMOVE EXISTING PUMP DISCONNECT SWITCH AND INSTALL NEW VARIABLE SPEED DRIVES W/ INTEGRAL DISCONNECT SWITCH AT EACH PUMP
3 EXIST. CHILLED WATER DIFFENTIAL BYPASS LINE
M-5
1:100
SBU



EX. CHILLER POWER (2) & CONTROL CIRCUIT

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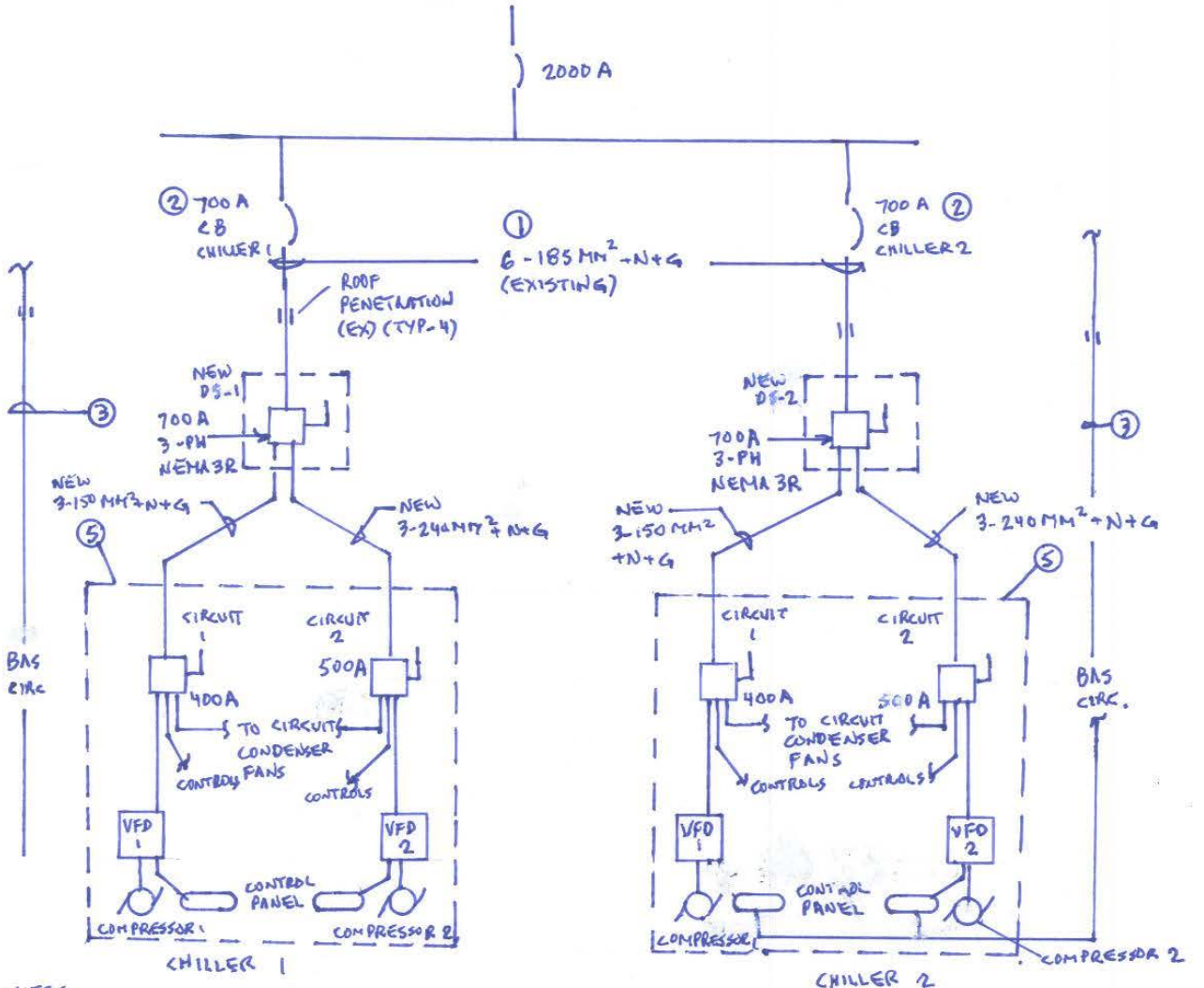


NOTES:

1. 6-185 MM² +N+G (EXISTING TO REUSE)
2. REPLACE EXISTING CIRCUIT BREAKER IN SWITCHBOARD W/NEW 700A CIRCUIT BREAKER
3. REPLACE EXISTING BAS CONTROL CABLES W/NEW. UPGRADE BAS SOFTWARE AS REQUIRED.
4. ALL POWER & CONTROL CABLES SHALL BE INSTALLED IN APPROPRIATE CONDUITS PER NEC.
5. ALL EQUIPMENT INSIDE DASHED LINES ARE INSTALLED BY CHILLER MANUFACTURER. CONTRACTOR TO PROVIDE NEW SERVICE CABLES AND WIRING.

OBC 250 TON CHILLER REPLACEMENT
RIYADH, SAUDI ARABIA

Chillers Package

Prepared For:

Date: 9/24/2012

Job Name: HMT American Embassy Riyadh Chillers

Prepared By:
HTS Austin

Notes

Table of Contents

Technical Data Sheet for ACC-1, 2

Job Name: HMT American Embassy Riyadh Chillers
Date: 9/24/2012
Submitted By: Derrick H Van West

Software Version: 03.30

Unit Description:

McQuay Model Number: AWS300BDH

Chiller Data:

Performance:	Capacity (ton):	253.3
	Input Power (kW):	406.4
	Performance (EER):	7.5
	IPLV (EER):	14.3
	Evap Flow (gpm):	434.3
	Evap PD (ft H_2O):	8.1
	Altitude (ft):	2,000
	ASHRAE 90.1:	'04, '07, '10
	LEED EA Credit 4:	Pass
Evaporator:	EWT (°F):	58.0
	LWT (°F):	44.0
	Delta T (Δ °F):	14.0
	Fouling Factor (°F.ft².h/Btu):	0.00010
	Percentage of Water:	100.0
	Minimum Flow Rate (gpm):	384.9
	Maximum Flow Rate (gpm):	876.4
Condenser:	Design Ambient (°F):	115.0
	Fan Diameter (in):	31.5
	Fan Motor HP:	1.4
	Fan RPM:	850
	Low Ambient Control to (°F):	35.0
	Unit Airflow (CFM):	177,360
Physical:	Length (in):	316
	Width (in):	88
	Height (in):	100
	Copper Coil Weight (if specified) (lb):	2,372
	Louver Weight (if specified) (lb):	0
	Shipping Weight of Specified Options (lb):	2,849
	Total Shipping Weight (lb)*:	19,943
	Total Operating Weight (lb)*:	20,310
	Refrigerant:	R134-a
	Refrigerant Charge (lb) (per unit):	500

** Shipping and operating weights take into account the platform but do not include option and accessory weights. Contact Chiller Applications for additional information*

Design Performance:

				Evaporator				Condenser	
Capacity (ton)	Input (kW)	Performance (EER)	IPLV (EER)	Flow (gpm)	PD (ft H_2O)	EWT (°F)	LWT (°F)	Ambient (°F)	Altitude (ft)
253.3	406.4	7.5	14.3	434.3	8.1	58.0	44.0	115.0	2,000

Performance Points rated at AHRI Ambient Relief:

						Evaporator			Condenser	
Point #	%Load Request	Capacity (ton)	Input Power (kW)	Performance (EER)	Flow (gpm)	PD (ft H_2O)	EWT (°F)	LWT (°F)	Ambient (°F)	Altitude (ft)
1	100.0	253.3	406.4	7.5	434.3	8.1	58.0	44.0	115.0	2,000
2	75.0	190.0	212.9	10.7	434.3	8.1	54.5	44.0	92.5	2,000
3	50.0	126.7	114.9	13.2	434.3	8.1	51.0	44.0	70.0	2,000
4	25.0	63.3	48.7	15.6	434.3	8.1	47.5	44.0	55.0	2,000

Sound Data With Sound Insulation:

Sound Pressure (at 30 feet)

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	100% Load Side dBA	100% Load Opposite Ctrl Box dBA	100% Load Ctrl Box End dBA	75% Load dBA	50% Load dBA	25% Load dBA
86	75	73	64	59	51	42	35	**68**	69	63	68	67	66	64

Sound Power

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA
113	102	100	90	86	78	69	62	**95**	94	93	91

Octave band is non 'A' weighted and overall readings are 'A' weighted. Sound data rated in accordance with AHRI Standard-370.

Unit Electrical Data:

Volts:	460	LRA Fan Motors (each) (A):	14
No. of Fan Motors:	16	FLA Fan Motors (each) (A):	3.4

	Single Pt (Power Block)	Multi Point (Disconnect)		
		Circuit 1	Circuit 2	Circuit 3
MCA:	549	302	302	N/A
Field Wire Gauge:	300 MCM	350 MCM	350 MCM	N/A
Field Wire Quantity:	6	3	3	N/A
Conduit Quantity:	2	1	1	N/A
Conduit Nom Size (in):	2.5	2.5	2.5	N/A
Rec Fuse Size (A):	700	450	450	N/A
Max Fuse Size (A):	700	500	500	N/A
Terminal Amps (A):	760	N/A	N/A	N/A
Disconnect Amps (A)	N/A	400	400	N/A
Connector Wire Range:	2-500(2/PH)	(2/PH) 3/0 - 500 kcmil	(2/PH) 3/0 - 500 kcmil	N/A

+ Both single and multiple point data are shown for user convenience. Refer to Acknowledgement for actual configuration.
+ Refer to the catalog for electrical information on other connection types.

Compressor Electrical Data:

Compressor Type / Quantity:	Screw/2
Starter Type:	Wye Delta

	Compressor		
	1	2	3
RLA:	220	220	N/A
Inrush Current:	386	386	N/A

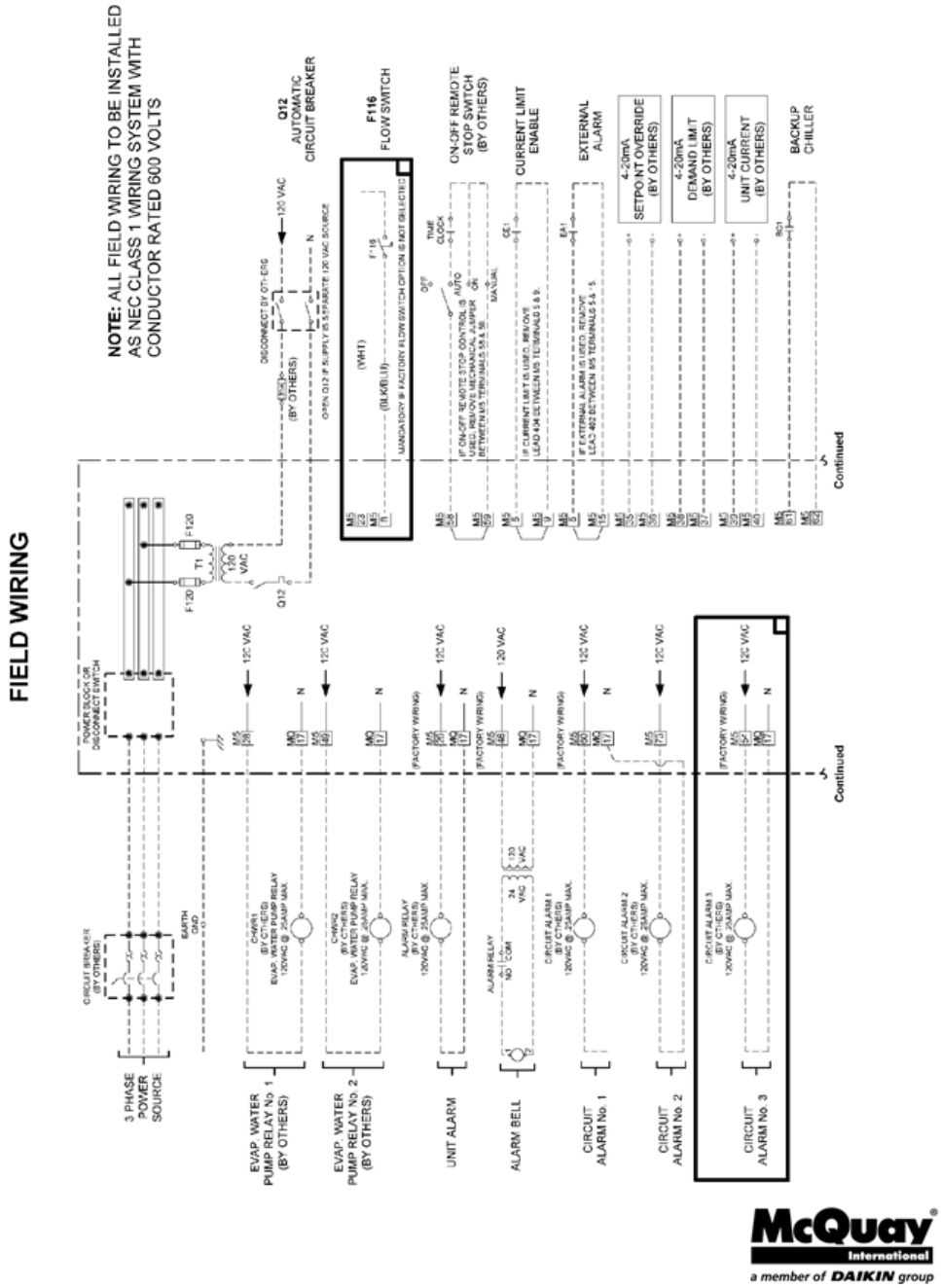
Certification:

Certified in accordance with the AHRI Air-Cooled Water Chilling Packages Using Vapor Compression Cycle Certification Program, which is based on AHRI Standard 550/590 (I-P) Certified units may be found in the AHRI Directory at www.ahridirector.org.

AWS_Combined_Drawings for ACC-1, 2

ACC-1 9/24/2012

Certified Drawing	CD: AWS (all models) Field Wiring Diagram
Job Name:	Group: **Chiller**
	Date: **July 2011**
Tag / Item No.:	Supersedes: **New**



McQuay International
a member of DAIKIN group

Certified Drawing	CD: AWS (all models) Field Wiring Diagram
Job Name:	Group: **Chiller**
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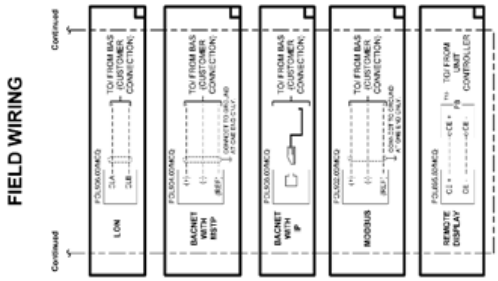

Field Wiring

Wiring must comply with all applicable codes and ordinances. Warranty does not cover damage to the equipment caused by wiring not complying with specifications. Pathfinder chillers can be ordered with main power wiring for either multi-point power connection (standard) or single-point connection (optional). If the optional single-point power connection is ordered, a single power connection is made to a power block (or optional disconnect switch) in the unit power panel. A separate disconnect is required if the optional factory-mounted disconnect is not ordered. Factory-mounted isolation circuit breakers for each circuit are included as standard on all single-point connection options.

If the standard multiple-point power wiring is ordered, two power connections are required on Pathfinder chiller models AWS###B**D**S or three power connections on AWS###B**T**S. They are made to factory-mounted disconnect switches in the power panel. See the dimension drawings for entry locations.

An open indicates a short, ground, or overload. Before replacing a fuse or restarting a compressor or fan motor, the trouble must be found and corrected. Copper wire is required for all power lead terminations at the unit, and copper must be used for all other wiring to the unit.

It can be desirable to have the unit evaporator heaters on a separate disconnect switch from the main unit power supply so that the unit power can be shut down without defeating the freeze protection provided by the evaporator heaters. See the field wiring diagram for connection details. The 120-volt control transformer is factory mounted and wired.

CAUTION

If a separate disconnect is used for the 120V supply to the unit, it must power the entire control circuit. It must be clearly marked so that it is not accidentally shut off during freezing temperatures, thereby de-energizing the evaporator heaters. Freeze damage to the evaporator could result. If the evaporator is drained for winter freeze protection, the heaters must be *de-energized* to prevent heater burnout.

CAUTION

Pathfinder unit compressors are single-direction rotation compressors and can be damaged if rotated in the wrong direction. For this reason, proper phasing of electrical power is important. Electrical phasing must be A, B, C for electrical phases 1, 2 and 3 (A=L1, B=L2, C=L3) for single or multiple point wiring arrangements. The solid-state starters contain phase reversal protection.
DO NOT ALTER THE WIRING TO THE STARTERS.

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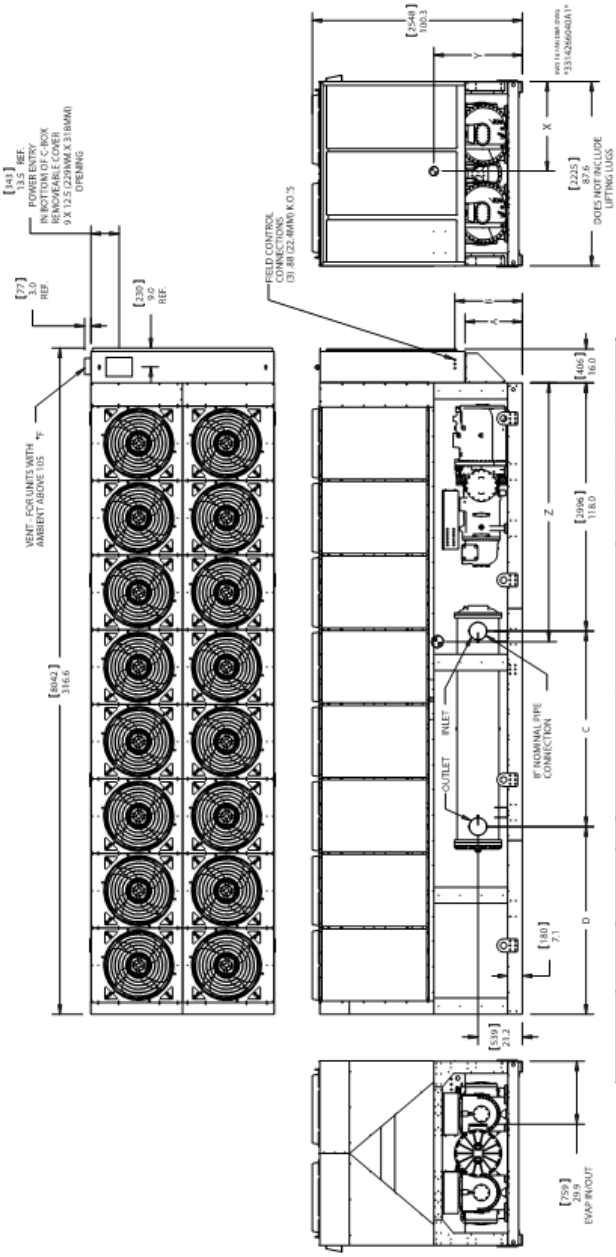
AWS_Combined_Drawings for ACC-1, 2

CERTIFIED DRAWING	CD: AWS300BDH (REV 0B)
JOB NAME:	GROUP: **CHILLER**
	DATE: July 2, 2012
TAG/ITEM No.:	SUPERSEDES: NEW

Dimensions

Note: All dimensions in decimal inches [mm]. Allow 1-inch manufacturing tolerance on all dimensions. The water connection shown is for the default configuration; your unit may be configured differently. Consult the Item Summary sheet for exact configuration.



MODEL NO.	VOLTAGE	STARTER	Hz	DIMENSIONS A		B		C		D		CENTER OF GRAVITY X		Y		Z	
				IN	MM	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
AWS240BDP	380-575V	SOLID STATE	60	27.4	696	32.3	820	92.9	2360	89.1	2263	43.7	1110	43.7	1110	116.5	2959
	208-575V	WYE DELTA		42.3	1074	47.2	1199					43.7	1110	44.0	1118	118.9	3020
AWS280-300BDH	380-575V	SOLID STATE		27.4	696	32.3	820					43.8	1113	42.7	1085	107.3	2725
	208-230V	WYE DELTA										43.7	1110	43.0	1092	109.4	2779
	380-575V	WYE DELTA		42.3	1074	47.2	1199					43.0	1092	42.6	1082	100.4	2550
AWS290BDS	380-575V	SOLID STATE		27.4	696	32.3	820					43.0	1092	42.6	1082	100.4	2550
	380-575V	WYE DELTA		42.3	1074	47.2	1199					43.0	1092	42.8	1087	102.4	2601
AWS310BDS	380-575V	SOLID STATE		27.4	696	32.3	820					43.7	1110	41.9	1064	98.7	2507
	380-575V	WYE DELTA		42.3	1074	47.2	1199					43.8	1113	42.1	1069	100.5	2553

DAIKIN McQUAY

CERTIFIED DRAWING	CD: AWS300BDH (REV 0B)
JOB NAME:	GROUP: **CHILLER**
	DATE: July 2, 2012
TAG/ITEM No.:	SUPERSEDES: NEW

Figure 1: Mounting and Lifting Locations

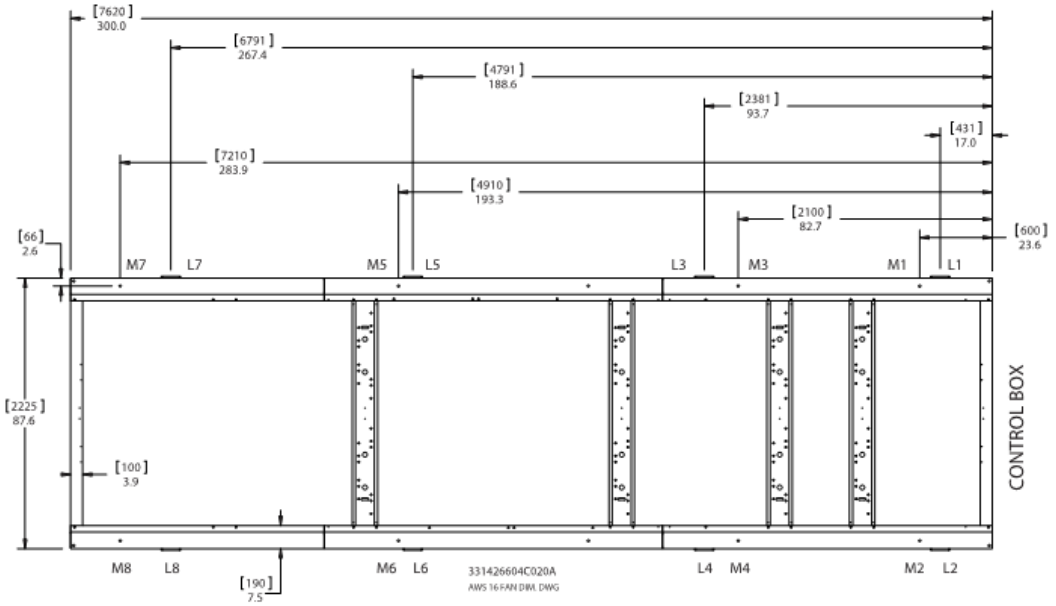


Table 1: Lifting and Mounting Weights

UNIT SIZE	Unit of Measure	LIFTING WEIGHT FOR EACH POINT (LBS)								MOUNTING LOADS FOR EACH POINT (LBS)											
		L1	L2	L3	L4	L5	L6	L7	L8	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
AWS300BDH	(LBS)	3065	3065	2455	2455	1701	1701	1075	1075	3206	3206	2711	2711	1786	1786	1028	1028	-	-	-	-
	(KG)	1328	1254	1090	1029	796	752	552	521	1398	1321	1202	1135	834	788	533	503	-	-	-	-

Table 2: Isolator kit part numbers and locations

UNIT SIZE	Type	Kit P/N	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
AWS300BDH	Spring Isolator Al Fin Condensers	332320846	332620900	332620900	332620800	332620800	332620600	332620600	332620400	332620400	N/A	N/A
			Gray	Gray	Dk. Green	Dk. Green	Dk. Purple	Dk. Purple	Red	Red		
	Spring Isolator Copper Fin Condensers	332320847	332620900	332620900	332620900	332620900	332620800	332620800	332620500	332620500	N/A	N/A
			Gray	Gray	Gray	Gray	Dk. Green	Dk. Green	Black	Black		
	RIS Isolator Al Fin Condensers	332325829	331481404	331481404	331481403	331481403	331481402	331481402	331481401	331481401	N/A	N/A
			Gray	Gray	Green	Green	Red	Red	Brown	Brown		
	RIS Isolator Copper Fin Condensers	332325832	331481404	331481404	331481404	331481404	331481402	331481402	331481401	331481401	N/A	N/A
			Gray	Gray	Gray	Gray	Red	Red	Brown	Brown		

Job: American Embassy Riyadh
Model: AWS310B
Tag: ACC-1, 2

Date: 1/17/2013
Version: 03.40

Unit Options:

Code Value	Description
AWS	UNIT TYPE; Air Cooled World Screw Chiller
310B	UNIT SIZE; 310B
D	NUMBER OF COMPRESSORS; 2 Compressors
PE	PLATFORM; Standard Package - Premium Efficiency
NN	CONSTRUCTION; Standard
ST	SOUND; Standard Sound
S	UNIT OPERATION; Standard Operation (40F - 60F LWT)
C	CONDENSER COIL FINS; Copper Fin
VF	COMPRESSOR STARTER; VFD without EMI Filters
27	VOLTAGE; 460v/60Hz/3PH
WN	POWER CONNECTION; Multi Point Disconnect Switches-No Circuit Breaker
N	PHASE VOLTAGE; None (PVM included as part of Solid State / VFD)
H	CONTROL BOX AMBIENT; With Exhaust Fans
N	COMPRESSOR CAPACITOR; None - Standard
LN	COMMUNICATION; LonMark
N	DISPLAY OPTIONS; On Controller Only
C	UNIT OPTIONS; 115v Convenience Outlet
A	WATER FLOW; Water Flow Indication on Evaporator Only
VR	EVAPORATOR CONNECTION; Victaulic / Right Hand
S	EVAPORATOR INSULATION; Std Evap - Single Layer Insulation
J	MOTOR COOLING; With Additional Liquid Injection Cooling
L	FANS; Low Noise Fan Motors
F	HEAD PRESSURE; Fantrol Only (35F Min.)
G	GUARDS; Condenser Coil Grilles Only
LD	TUBING OPTIONS; w/Liquid Line Solenoid & Discharge Shut-Off Valve
E	APPROVALS; ETL/cETL, AHRI & ASHRAE 90.1
N	CRN-EVAPORATOR; No CRN Required
DPL	STANDARD WARRANTY; Domestic, 1yr. Standard Warranty-Parts & Labor
CPE4	EXT COMPRESSOR WTY; Compressor Only-Ext. 4 year parts only
M	BRAND NAME; McQuay
6	HERTZ; 60 Hertz
0B	UNIT REVISION; Major Unit Revision Change - B

Specification for ACC-1, 2

PART 1: GENERAL

1.01 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled rotary screw packaged chillers.

1.02 REFERENCES

A. Comply with applicable Standards/Codes of ARI 550/590, ANSI/ASHRAE 15, ASHRAE 90.1 current version requirements, and ASME Section VIIII.

B. SUBMITTALS

C. Submit shop drawings and product data in accordance with specification requirements.

D. Submittals shall include the following:

1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections, Got CADD Drawing of the chiller only
2. 1/3 octave band sound ratings per ARI Standard 370.
3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
4. Certification of factory run test.
5. Installation manuals.

1.03 QUALITY ASSURANCE

A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the equipment and refrigerant offered.

B. Regulatory Requirements: Comply with the codes and standards specified.

C. Chiller must be manufactured in an ISO certified facility.

1.04 DELIVERY AND HANDLING

A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

B. Comply with the manufacturer's instructions for rigging and handling.

C. If unit is to be stored, comply with manufacturer instructions for storage.

1.05 WARRANTY

A. Standard Warranty (domestic): The refrigeration equipment manufacturer's warranty shall be for a period of one (1) year from date of equipment start up, but not more than 18 months from shipment. It shall cover replacement parts (and the labor to replace them) having proven defective within the above period.

B. Extended Compressor Warranty: 2^{nd} thru 5^{th} year. Is the option going to be available and how shall it be processed. Any precautions?

C. Extended Unit Warranty: none.

D. Refrigerant Warranty: None.

E. Delayed Warranty Start: None. (Startup within 6 months of shipment)

1.06 Sustained Operational Performance and Reliability

A. During the first 12 months of operation, the manufacturer shall perform quarterly remote or on-site. Operating inspections to confirm the chiller's operational performance. Resulting from each inspection, the manufacturer shall provide the owner with a report describing the condition of the equipment and each of its major components, a log of its current operating data, any issues needing to be addressed, and any recommended corrective actions.

1.07 Summary of General Options

A. Warranty: List design requirement options listed in section 1.06.
B. Sustained Operational Performance: List design requirement options listed in section 1.07.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of Design - McQuay Pathfinder™ Chiller Model AWS, including the standard product features and all special features required per the plans and specifications.
B. Equal Products - Equipment manufactured by [ENTER MANUFACTURER NAME HERE] may be acceptable as an equal. Naming these products as equal does not imply that their standard construction or configuration is acceptable or meets the specifications. Equipment proposed "as equal", must meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.

2.02 UNIT DESCRIPTION

A. Provide and install as shown on the plans, (these are the hand drawn plans Mike has provided page 8 to 13) factory assembled, factory charged with R-134a, air-cooled, rotary-screw compressor packaged chillers in the quantity and size specified. Each chiller shall consist of multiple semi-hermetic screw compressors, direct-expansion evaporator, air-cooled condenser section, control system and all components necessary for protected and controlled unit operation.

2.03 DESIGN REQUIREMENTS

A. General: Provide a complete rotary-screw packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02.
B. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum of 12.5% percent of full load without hot gas bypass. The unit shall have factory mounted, low ambient head pressure control providing operation to 35ºF (-4.4ºC).
C. The unit shall provide ventilation in the controller to provide operation above 105°F up to 125°F ambient air temperatures.
D. Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per ARI 370 must be provided in 8 octave band format at full load. In addition, A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope. Sound power must be provided in 1/3 octave band format to highlight any tonal quality issues. If manufacturer cannot meet the noise levels (per the attached chart), sound attenuation devices and/or barrier walls must be installed to meet this performance level. Test run should have confirmed that the chiller is running at the proposed/ desired noise levels if this is not the case a wall / sound attenuation devise placement is part of the install and the proposal should clearly indicate the wall construction and cost so if it is needed it can be added or removed if it is not required after the install noise testing has been carried out.

2.04 CHILLER COMPONENTS

A. Compressors: The compressors shall be field-serviceable, semi-hermetic, single-rotor screw type with one central helical rotor meshing with two opposing gaterotors. The gaterotor contact element shall be constructed of engineered composite material, dimensionally stable up to 1500ºF and wear-resistant for extended life. Compressors shall be vibration isolated from the frame by neoprene compression mounts. If a twin-screw design is used, the manufacturer shall provide an extended 5-year parts and labor warranty covering all additional moving parts. Each compressor shall have a discharge shut-off valve.

B. Electric motors: Motors shall be high-torque; two-pole, semi-hermetic, squirrel-cage induction-type with inherent thermal protection on all three phases, and cooled by suction gas.

C. Each compressor shall be equipped with an open transition, wye-delta starter.

D. Evaporator: The evaporator shall be of the direct expansion type with single pass on the refrigerant and water side for high efficiency counterflow heat transfer and low pressure drops, carbon steel shell, and high efficiency finned coppertubes rolled into steel tube sheets. The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIIII requirements. It shall be heated with a thermostatically controlled electric heater to help freeze protection to -20ºF (-29ºC). The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIIII requirements.
   1. Flow Switch: Chilled water flow switch to be factory-mounted in the chilled water outlet nozzle and factory wired to terminals in the control panel.
   2. Evaporator shall have standard left-hand connections when looking at the unit control panel.
   3. The evaporator shall be insulated with ¾-inch (19 mm) closed cell polyurethane insulation.

E. Condenser: The condenser coils shall have seamless copper tubes, mechanically bonded into aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main condenser coil. Condenser fans shall be propeller-type, arranged for vertical air discharge and individually driven by direct-drive fan motors. Fan motors shall be weather protected, three-phase, direct-drive, 850 rpm, totally enclosed air-over motors (TEAO), with class F insulation or better. ODP motors are not acceptable. Each fan shall be housed in its own compartment to eliminate condenser air cross-flow during fan cycling and shall be equipped with a heavy-gauge close-meshed PVC-coated fan guard.

F. Refrigerant Circuit: The unit must have refrigerant circuits completely independent of each other with one compressor per circuit. Each circuit shall include an electronic expansion valve, liquid line shut-off valve, replaceable core filter-drier, sight glass with moisture indicator, and combination discharge check and shutoff valve. Unit shall be equipped with a liquid line solenoid valve.

G. Unit casing and all structural members and rails shall be fabricated of steel and painted to meet ASTM B117 500-hour salt spray test. The control enclosure and unit panels shall be corrosion resistant painted before assembly. Unit shall have condenser coil grilles.

H. Advanced microprocessor based control system:
   1. Control Panel: Multi-point power supply to factory-mounted disconnect switches with through-the-door handles, for each compressor circuit, no circuit breakers. A NEMA Type 3R weatherproof control panel shall contain the unit control system, control interlock terminals and field-power connection points. Hinged control panel access doors shall be tool-lockable. Barrier panels shall be provided to protect against accidental contact with line voltage when accessing the control system. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection. Factory-supplied power components shall include:
      a. Individual contactors and circuit breakers for fan motors,

b. Circuit breakers and factory-mounted transformers for each control-circuit,
c. Unit power terminal blocks for connection to remote disconnect switch,
d. Terminals for power supply to the evaporator heater circuit.
e. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.
f. Single-Point Connection to Disconnect Switch
g. A 10.0 amp, 115-volt convenience outlet shall be mounted inside the control panel on all 60-Hz units.

2. Control system starting components shall include solid-state start timer.
3. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions and to provide a history of operating conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.
4. Equipment protection functions controlled by the microprocessor shall include high discharge pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. User controls shall include:
   a. auto/stop switch,
   b. chilled water set-point adjustment,
   c. anti-recycle timer,
   d. digital display with water temperature and set point,
   e. Operating temperatures and pressures, and diagnostic messages.
5. The following features and functions shall be included:
   a. Durable liquid crystal display (LCD) screen type, having minimum four 20-character lines with 6 key input pad conveniently mounted on the unit controller. Default language and units of measure shall be English and I-P respectively. Messages shall be in plain English. Coded messages, LED indicators and LED displays are not acceptable.
   b. Separate control section and password protection for critical parameters.
   c. Remote reset of chilled water temperature using a 4-20mA signal.
   d. Soft-load operation, protecting the compressor by preventing full-load operation during the initial chilled fluid pull-down period.
   e. Non-volatile program memory allowing auto-restart after a power failure.
   f. Recording of safety shutdowns, including date-and-time stamp, system temperatures and pressures. A minimum of six previous occurrences shall be maintained in a revolving memory.
   g. Start-to-start and stop-to-start cycle timers, providing minimum compressor off time while maximizing motor protection.
   h. Lead-lag compressor staging for part-load operation by manual selection or automatically by circuit run hours.
   i. Discharge pressure control through intelligent cycling of condenser fans to maximize efficiency.
   j. Pro-active compressor unloading when selected operating parameters exceed design settings, such as high discharge pressure or low evaporator pressure.
   k. Diagnostic monitoring of unit operation, providing a pre-alarm signal in advance of a potential shutdown, allowing time for corrective action.
   l. 115-volt convenience outlet mounted in control panel for all 60-Hz units.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install in strict accordance with manufacturer's requirements, submittal drawings, and contract documents.

B. A 20-mesh strainer shall be placed in the supply water line just prior to the inlet of the evaporator. Care shall be exercised when welding pipe or flanges to the evaporator to prevent any slag from entering the vessel.

C. Adjust and level chiller in alignment on supports.

D. Coordinate electrical installation with electrical contractor.

E. Coordinate controls with control contractor.

F. Provide all appurtenances required to ensure a fully operational and functional chiller.

Please note that all applicable/relevant portions of the following Sections are to be considered as the prevailing guidelines and acceptable level of specification for this project.

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Shelf angles.
4. Support angles for elevator door sills.
5. Metal edgings.

1.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 67 deg C, ambient; 100 deg C, material surfaces.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining (without failure) load imposed within safety factor of four, as determined by testing per ASTM E 488, conducted by qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized in accordance with ASTM A 153/A 153M.

G. Galvanized Pipe and Sleeves: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with Z275 coating; 2.8-mm nominal thickness.

H. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209M , Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221M , Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded Architectural bronze).

G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

2.4 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563M; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.7M.

E. Lag Bolts: ASME B18.2.3.8M.

F. Plain Washers: Round, carbon steel, ASME B18.22M.

G. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.2M.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain (without failure) load equal to six times load imposed when installed in unit masonry and equal to four times load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated complying with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 738M and nuts complying with ASTM F 836M.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 20 MPa, unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1 mm, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces so they are smooth and blended, so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 67 deg C, ambient; 100 deg C, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts.

2.7 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 200 mm, unless otherwise indicated.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports indicated and as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 32 mm wide by 6 mm thick by 200 mm long at 600 mm o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete construction, spaced not more than 150 mm from each end, 150 mm from corners, and 600 mm o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior.
2. Interior, where indicated.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

2.13 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.14 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by Aluminum Association (AA) for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 0.05-mm dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

Index of Appendices and General Common Specifications and Guideline for the Project Elements is detailed below and provided as soft copy to form part of this project.

GENERAL SPECIFICATIONS INDEX.

SECTION 055000 - METAL FABRICATIONS

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

SECTION 230905 - INSTRUMENTATION AND CONTROLS FOR HVAC

SECTION 236426 - ROTARY-SCREW AIR-COOLED WATER CHILLERS

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (USE APPLICABLE SECTIONS ONLY)

SECTION 260535 – SURFACE-MOUNTED RACEWAYS FOR ELECTRICAL SYSTEMS

SECTION 262913 - ENCLOSED CONTROLLERS (USE APPLICABLE SECTIONS ONLY)

SECTION 099600 - HIGH-PERFORMANCE COATINGS

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

SECTION 260126 - FIELD TESTING AND INSPECTION OF ELECTRICAL SYSTEMS

SECTION 232113 - HYDRONIC PIPING

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS (USE APPLICABLE SECTIONS ONLY)

SECTION 260913 - ELECTRICAL POWER MONITORING AND CONTROL (USE APPLICABLE SECTIONS ONLY)

SECTION 262923 - VARIABLE FREQUENCY MOTOR CONTROLLERS (USE APPLICABLE SECTIONS ONLY)

SECTION 230505 - COMMON WORK RESULTS FOR FIRE-SUPPRESSION, PLUMBING AND HVAC

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

SECTION 230719 – HVAC PIPING INSULATION

SECTION 232123 - HYDRONIC PUMPS

SECTION 260505 – COMMON WORK RESULTS FOR ELECTRICAL, COMMUNICATIONS AND ELECTRONIC SAFETY

SECTION 260534 - RACEWAYS AND BOXES

SECTION 262726 - WIRING DEVICES (USE APPLICABLE SECTIONS ONLY)

OTHER DOCUMENTS.

PDF of Chillers

CAD file of chillers

Carnage/Rigging Diagram